

IN THE CLAIMS:

Please amend Claims 1-4, 7, 9-11, 17-20, and 39 as follows. A marked-up copy of the amended claims showing the changes made thereto, is attached. Note that all the claims currently pending in this application, including those not presently being amended, have been reproduced below for the Examiner's convenience.

sub 01  
1. (Twice Amended) A simulator apparatus with which an operator plays a simulation with virtual object(s) in mixed reality space including a virtual space and real space, said simulator comprising:

a viewpoint detection unit adapted to detect the location/posture of a viewpoint of the operator;

an inputting unit adapted to input a real space image corresponding to the location/posture of a viewpoint of the operator;

B1  
a geometric information acquisition unit adapted to recognize geometric information of real object(s);

a recognition unit adapted to recognize a current relative relationship between the virtual object(s) and real object(s);

a rule memory adapted to store rules for controlling the action of the virtual object(s);

a computation unit adapted to determine the next action of the virtual object(s) in accordance with the rules stored in said rule memory and in correspondence with the location/posture of the real object(s), and to compute the location/posture of the virtual object(s) after the determined action; and

B1 a presentation unit adapted to generate at least one image of the virtual object(s) on the basis of the location/posture of the virtual object(s) after the determined action and the location/posture of the viewpoint position of the operator, and to represent the mixed reality space to the operator by superimposing the image(s) of the virtual object(s) on the operator's view of the real space.

2. (Amended) The apparatus according to claim 1, wherein said presentation unit further comprises:

an image-capturing unit adapted to capture real space images of said operator's view of real space images of said player's view of the real space;

an image generation unit adapted to generate mixed reality images representing the mixed reality space by superimposing or overlaying said image(s) of the virtual object(s) on said real space images; and

B2 a video see-through type display that the operator wears wherein said mixed reality images are displayed.

3. (Amended) The apparatus according to claim 1, wherein said presentation unit further comprises an optical see-through type display that the operator wears wherein said virtual object image(s) are displayed.

4. (Amended) The apparatus according to claim 1, further comprising, a status detector that detects a status of the operator;

B2 wherein said computation unit determines a next action of the virtual object in accordance with the rule stored in said rule memory and in correspondence with the location/posture of the real object and/or the status of the operator, and computes a location/posture of the virtual object after the determined action.

5. (Not Presently Amended) The apparatus according to claim 1, wherein the current relative relationship includes a layout relationship between the virtual object and real object at the current time in the mixed reality space.

6. (Not Presently Amended) The apparatus according to claim 1, wherein the current relative relationship includes a behavior of the real object with respect to the virtual object at the current time in the mixed reality space.

B3 7. (Amended) The apparatus according to claim 1, wherein the real object includes the operator himself or herself, and said recognition unit recognizes a current relative relationship between the virtual object and the operator.

8. (Not Presently Amended) The apparatus according to claim 1, wherein the real object includes a plurality of operators who operate said simulator apparatus, and the plurality of operators share a single mixed reality space.

B4 9. (Amended) The apparatus according to claim 1, wherein the real object is an object which is fixed in position, and

said geometric information acquisition unit comprises:

a predetermined memory for pre-storing location information and shape information of the real object; and

a reading unit that reads out the location information and shape information of the real object from said predetermined memory as needed.

SUBC3

10. (Amended) The apparatus according to claim 1, wherein the real-object is an object which is movable but does not deform, and

said geometric information acquisition unit comprises:

a predetermined memory for pre-storing shape information of the real object;

a location/posture sensor for detecting a location/posture of the real object; and

a setting unit that sets a region the real object is expected to occupy in the mixed real space in accordance with the detected location/posture of the real object.

B4

11. (Amended) The apparatus according to claim 1, wherein the real object is an operator, and

said geometric information acquisition unit comprises:

a sensor for detecting a location/posture of a head of the operator;  
and

34

a setting unit that sets a region having a fixed, known shape that approximates the operator in the mixed reality space in accordance with the detected location/posture of the operator's head.

---

12. (Not Presently Amended) The apparatus according to claim 1, wherein when the simulation is a battle simulation with the virtual object, an objective is to decrease an expected score of the operator.

13. (Not Presently Amended) The apparatus according to claim 1, wherein when the simulation is a cooperative simulation with the virtual object, an objective is to increase an expected score of the simulation.

14. (Not Presently Amended) The apparatus according to claim 1, wherein one of the rules stored in said rule memory controls the action of the virtual object on the basis of an objective of the simulation and a relative relationship between the virtual object and real object.

15. (Not Presently Amended) The apparatus according to claim 1, wherein one of the rules stored in said rule memory expresses the action of the virtual object as an action pattern with a predetermined aim for achieving an objective of the simulation.

16. (Not Presently Amended) The apparatus according to claim 15, wherein the pattern has a path disadvantageous to the operator in consideration of a layout relationship between the virtual object and real object.

17. (Amended) The apparatus according to claim 11, wherein when the operator is one of the real objects, an output from said viewpoint detection unit for detecting the location/posture of the viewpoint of the operator is also used as information which is to be acquired by said geometric information acquisition unit and pertains to a location and shape of the operator.

B5 18. (Amended) The apparatus according to claim 1, wherein said viewpoint detection unit detects a location/posture of the head of the operator, and said apparatus further comprises a detector that detects a location/posture of a hand of the operator; and a recognition unit adapted to recognize a relative location of the hand of the operator with respect to the head as a command on the basis of an output from said detector.

sub 19. (Amended) The apparatus according to claim 1, wherein said presentation unit comprises:

an alignment unit that aligns the location/posture of the real object to the location/posture of the virtual object after movement;

a generation unit that generates an image of the virtual object after alignment in correspondence with an occlusion relationship; and  
a head-mounted display device.

20. (Twice Amended) An image processing method for a simulator apparatus with which an operator plays a game with virtual object(s) in a mixed reality space comprising:

a viewpoint detection step for detecting the location/posture of a viewpoint of the operator;

135 an inputting step for inputting a real space image corresponding to the location/posture of a viewpoint of the operator;

a geometric information acquisition step for acquiring geometric information of real object(s);

a recognition step for recognizing a current relative relationship between the virtual object(s) and real object(s);

a computation step for determining the next action of the virtual object(s) in accordance with the rules stored in a rule memory, which stores rules for controlling the action of the virtual object(s), and in correspondence with the location/posture of the real object(s), and computing the location/posture of the virtual object(s) after the determined action; and

a presentation step for generating at least one image of the virtual object(s) on the basis of the location/posture of the virtual object(s) after the determined action and the location/posture of the viewpoint position of the operator, and for representing the

B5 mixed reality space to the operator by superimposing the image(s) of virtual object(s) on the operator's view of the real space.

---

21. (Not Presently Amended) The method according to claim 20, wherein the operator wears a video see-through type display, and said presentation step further comprising,

image-capturing step for capturing real space images of said operator's view of the real space;

image generation step for generating mixed reality images representing of the mixed reality space by superimposing or overlaying said image(s) of virtual object(s) on said real space images and for displaying said mixed reality images on the display.

22. (Not Presently Amended) The method according claim 20, wherein the operator wears an optical see-through type display and said presentation step representing the mixed reality space to the operator by displaying the image(s) of virtual object(s) on the display.

23. (Not Presently Amended) The method according to claim 20, further comprising,

status detecting step for detecting status of the operator;

wherein said computation step determines a next action of the virtual object in accordance with the rule stored in said rule memory and in correspondence with the



location/posture of the real object and/or the status of the operator, and computing a location/posture of the virtual object after the determined action.

24. (Not Presently Amended) The method according to claim 20, wherein the recognition step recognizes the current relative relationship including a layout relationship between the virtual object and real object at the current time in the mixed reality space.

25. (Not Presently Amended) The method according to claim 20, wherein the recognition step recognizes the current relative relationship including a behavior of the real object with respect to the virtual object at the current time in the mixed reality space.

26. (Not Presently Amended) The method according to claim 20, wherein the recognition step includes the step of recognizing a current relative relationship between the virtual object and the operator, and the real object includes the operator himself or herself.

27. (Not Presently Amended) The method according to claim 20, wherein a plurality of operators share a single mixed reality space and the real object(s) used in the computation step includes a plurality of operators who operate the apparatus.

28. (Not Presently Amended) The method according to claim 20, wherein the real object is an object which is fixed in position, and

the geometric information acquisition step includes the steps of:  
pre-storing location information and shape information of the real object in  
a predetermined memory; and  
reading out the location information and shape information of the real object  
from the predetermined memory as needed.

29. (Unamended) The method according to claim 20, wherein the real  
object is an object which is movable but does not deform, and  
the geometric information acquisition step includes the steps of:  
pre-storing shape information of the real object in a predetermined  
memory;  
detecting a location/posture of the real object by a location/posture  
sensor; and  
setting a region the real object is expected to occupy in the mixed  
real space in accordance with the detected location/posture of the real  
object.

30. (Not Presently Amended) The method according to claim 20, wherein  
the real object is an operator, and  
the geometric information acquisition step includes the steps of:  
detecting a location/posture of the head of the operator; and  
setting a region having a fixed, known shape that approximates the operator  
in the mixed reality space in accordance with the detected location/posture of the head.

31. (Not Presently Amended) The method according to claim 20, wherein when the simulation is a battle simulation with the virtual object, an objective used in said computation step is to decrease an expected score of the operator.

32. (Not Presently Amended) The method according to claim 20, wherein when the simulation is a cooperative simulation with the virtual object, an objective used in said computation step is to increase an expected score of the operator.

33. (Not Presently Amended) The method according to claim 20, wherein one of the rules controls the action of the virtual object on the basis of an objective of the simulation and a relative relationship between the virtual object and real object.

34. (Not Presently Amended) The method according to claim 20, wherein one of the rules stored in the rule memory expresses the action of the virtual object as an action pattern with a predetermined aim for achieving the objective of the simulation.

35. (Not Presently Amended) The method according to claim 34, wherein said computation step determines an action using a pattern having a path disadvantageous to the operator in consideration of a layout relationship between the virtual object and real object.

36. (Not Presently Amended) The method according to claim 30, wherein when the operator is one of real objects, said geometric information acquisition step uses

an output from said viewpoint detection step of detecting the location/posture of the viewpoint of the operator that pertains to a location and shape of the operator.

37. (Not Presently Amended) The method according to claim 20, wherein the viewpoint detection step includes the step of detecting a location/posture of the head of the operator , and

said method further comprises the detection step of detecting a location/posture of a hand of the operator; and

the step of recognizing a relative location of the hand of the operator with respect to the head as a command on the basis of an output in the detection step.

38. (Unamended) The method according to claim 20, wherein the presentation step includes the steps of:

aligning the location/posture of the real object to the location/posture of the virtual object after movement; and

generating an image of the virtual object after alignment in correspondence with an occlusion relationship.

5428  
34

39. (Twice Amended) A storage medium which stores a program of an image processing method for a simulator apparatus with which an operator plays a simulation with virtual object(s) in a mixed reality space including a virtual space and real space comprising: